We claim:

1. A photonic crystal waveguide for coupling with optic devices comprising:
a planar photonic crystal slab in which an array of holes is defined; and
a waveguide defined by a line defect defined in said slab, said line defect being created by a geometric perturbation of at least a first set of holes with respect to a second set of holes to create at least one guided mode of light propagation in said waveguide which exhibits reduced vertical and lateral losses, increased coupling of light into said slab, and closer matching of frequencies of eigen modes of said optic devices coupled to said waveguide.

2. The waveguide of claim 1 where said geometric perturbation is a positional displacement of said first set of holes with respect to said second set of holes in a predetermined direction, said first and second set of holes having the same diameter of hole therein.

3. The waveguide of claim 1 where said predetermined direction is the ΓX direction in said slab, said waveguide being defined as a type 1 waveguide.

4. The waveguide of claim 1 where said predetermined direction is the ΓJ direction in said slab, said waveguide being defined as a type 2 waveguide.

5. The waveguide of claim 4 where said positional displacement, d, is a fraction, l, of lattice spacing, a, of said array, $d = l \cdot a$, where $0 < l < 1$.

6. The waveguide of claim 5 where $d = 0.5a$.

7. The waveguide of claim 5 where said waveguide has a bandgap and where d is reduced until both acceptor-type modes and donor-type modes are positioned in the bandgap of said waveguide.

8. The waveguide of claim 1 where said slab has a bandgap, an air band and a dielectric band for propagation of modes and where said geometric perturbation is created by displacement of holes into a positions within said array of holes where dielectric is normally present to pull modes from the dielectric band into the bandgap.

9. The waveguide of claim 1 where said slab has a bandgap, an air band and a dielectric band for propagation of modes and where said geometric perturbation is created by displacement of dielectric into a positions within said array of holes where air is normally present to pull modes from the air band into the bandgap.

10. The waveguide of claim 1 where said geometric perturbation is created by increasing or decreasing the diameter of a first set of holes in said array of holes relative to a second set of holes comprising a remainder of holes of said array, said first set of holes being adjacent at least in part to said line defect, said waveguide defined as a type-3 waveguide.

11. The waveguide of claim 10 where slab has a bandgap and an air band and where second set of holes has a radius, $r = 0.3a$ and said first set of holes has a radius, $r_{defect} = 0.2a$ and said array of holes has a triangular lattice so that only air band modes are pulled down in the bandgap and no acceptor-type modes are present.

12. The waveguide of claim 10 where slab has a bandgap and an air band and where second set of holes has a radius, $r = 0.3a$ and said first set of holes has a radius, $r_{defect} = 0.45a$ and said array of holes has a triangular lattice so that only acceptor-type modes are present.

13. The waveguide of claim 1 where said light is guided in said waveguide due to photonic bandgap (PBG) effect.

14. A method for defining a photonic crystal waveguide for coupling with optic devices comprising:

defining an array of holes in a planar photonic crystal slab; and

creating a line defect in said slab to define said waveguide, said line defect being created by a geometric perturbation of at least a first set of holes with respect to a second set of holes to create at least one guided mode of light propagation in said waveguide which exhibits reduced vertical and lateral losses, increased coupling of light into said slab, and closer matching of frequencies of eigen modes of said optic devices coupled to said waveguide.

15. The method of claim 14 where creating said line defect comprises forming said first set of holes displaced in a predetermined direction with respect to said second set of holes, said first and second set of holes having the same diameter of hole therein.

16. The method of claim 14 where forming said first set of holes displaces said holes in the ΓX direction in said slab, said waveguide being defined as a type 1 waveguide.

17. The method of claim 14 where forming said first set of holes displaces said holes in the ΓJ direction in said slab, said waveguide being defined as a type 2 waveguide.

18. The waveguide of claim 17 where forming said first set of holes displaces said holes by a displacement, d, is a fraction, l, of lattice spacing, a, of said array, $d = l \cdot a$, where $0 < l < 1$.

19. The method of claim 18 where forming said first set of holes displaces said holes by a displacement, $d = 0.5$.

20. The method of claim 18 where said waveguide has a bandgap and where forming said first set of holes displaces said holes by a d which is reduced until both acceptor-type modes and donor-type modes are positioned in the bandgap of said waveguide.

21. The method of claim 14 where said slab has a bandgap, an air band and a dielectric band for propagation of modes and where creating said line defect comprises forming said first set of holes displaced by displacement of holes into positions within said array of holes where dielectric is normally present to pull modes from the dielectric band into the bandgap.

22. The method of claim 14 where said slab has a bandgap, an air band and a dielectric band for propagation of modes and where creating said line defect comprises forming said first set of holes displaced by displacement of holes into

positions within said array of holes where air is normally present to pull modes from the air band into the bandgap.

23. The method of claim 1 where creating said line defect comprises increasing or decreasing the diameter of a first set of holes in said array of holes relative to a second set of holes comprising a remainder of holes of said array, said first set of holes being adjacent at least in part to said line defect, said waveguide defined as a type-3 waveguide.

24. The method of claim 23 where slab has a bandgap and an air band and where creating said line defect comprises decreasing the diameter of a first set of holes to a radius, $r_{defect} = 0.2a$ and said second set of holes has a radius, $r = 0.3a$ and said first set of holes has said array of holes has a triangular lattice so that only air band modes are pulled down in the bandgap and no acceptor-type modes are present.

25. The method of claim 23 where slab has a bandgap and an air band and where creating said line defect comprises increasing the diameter of a first set of holes to a radius $r_{defect} = 0.45a$, where second set of holes has a radius, $r = 0.3a$, and said array of holes has a triangular lattice so that only acceptor-type modes are present.

26. The method of claim 1 where creating said line defect comprises guiding light in said waveguide solely due to photonic bandgap (PBG) effect.